Science Connection
KENTUCKY DEPARTMENT OF EDUCATION
A Collaborative Resource for Teachers
VOLUME 1 ISSUE 1

In This Issue

A Victim of "Why?"

Katrina Slone
KDE Instructional Specialist

K-2

"Practice One: Asking Questions and Defining Problems" only shows up twice in the K-2 grade band in the Next-Generation Science Standards (NGSS). So, does that mean we need to teach/use it only in context of kindergarten ESS3-2, "Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather" or in K-2-ETS1-1, "Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool?" Well, no.

Asking good questions and defining problems well is an ongoing skill students learn and continue to practice throughout all of the science content they learn. While it is the focus of just two performance expectations in K-2, it is embedded in all of them. For example, how does one "Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object" (K-PS2-1) without first asking a question that can be investigated? Why would one "Use tools and materials provided to design and build a structure that will reduce the warming effect of sunlight on Earth's surface" (K-PS3-2) without defining a problem to solve?

So what does it look like in a K-2 classroom when students are being expected to ask questions and define problems? Little kids have lots of questions. If you have ever been the victim of a "why?" assault by a 3-year-old, you know what I mean. However, sometimes

See Victim on Page 11

How can one explain the ways cells contribute to the function of living organisms?

Hallie Booth
KDE Instructional Specialist

MS

The LS1 Disciplinary Core Idea from the National Research Council (NRC) Framework is organized into four sub-ideas: Structure and Function, Growth and Development of Organisms, Organization for Matter and Energy Flow in Organisms, and Information Processing. Students can gather information and use this information to support explanations of the structure-and-function relationship of cells. They can communicate understanding of cell theory. They have a basic understanding of the role of cells in body systems and how those systems work to support the life functions of the organism. The understanding of cells provides a context for the plant process of photosynthesis and the movement of matter and energy needed for the cell. Students can construct an explanation for how environmental and genetic factors affect growth of organisms. They can connect this to the role of animal behaviors in reproduction of animals as well as the dependence of some plants on animal behaviors for their reproduction. Crosscutting concepts of cause and effect, structure and function, and matter and energy are called out as organizing concepts for the core ideas about processes of living organisms.

There is a wonderful teaching channel video, www.teachingchannel.org/videos/ninth-grade-biology-lesson?fd=1, that

See Living Organisms on Page 10

NEXT GENERATION SCIENCE STANDARDS

Practice
Asking questions and Defining Problems

DCI
LS1 From Molecules to Organisms: Structure and Function

Crosscutting Concept
Patterns

Chemistry Transformation

Tom Tretter
Associate Professor of Science
Education Director, Gheens Science Hall and Rauch Planetarium
University of Louisville

HS

A great resource for seeing how one high school chemistry teacher took her typical class and, systematically over the course of a year, transformed the students into effective and skilled question-generators and problem solvers is presented in "*Whole-Class Inquiry: Creating Student-Centered Science Communities*" by Dennis Smithenry and Joan Gallagher-Bolos from NSTA Press at www.nsta.org/publications/press/extras/wholeclassinquiry.aspx.

Summary of resource:

- The book and videos detail the very intentional strategy used by the teacher over the course of a year, and how the foci carefully changed to include more and more sophisticated expectations from students. The chapters are sequential so you can follow the progression from student novices to experts over the academic year. Video clips illustrating how this looked in practice are included.
- The teacher has a well-reasoned strategy for what she focuses on for each of the year-long sequence of labs, beginning with topics like "safety," "how to treat each other" and "how to ask good questions" at the beginning of the year.
- You can get a flavor of this text and associated videos at the website. For example, read the Chapter 2 Video Transcripts "CHEMCO Video Case Transcript." From timestamp 8:05 on page 3 to 13:40 on page 5, you'll find the teacher processing feedback with a class using data from all of her classes combined (and she gives the class reasons why she combines feedback from all of her classes). In this transcript section, you'll note elements of how she is guiding and reinforcing what are good questions and what are poor questions. She also is reinforcing and establishing learning-climate expectations for how kids are to talk with one another.
- For a sense of the inquiry expectations later in the year, go to the Chapter 5 Video Transcript "SOLN Video Case Transcript." At timestamp 3:12 on page 2 to the end of page 4, you'll see the students' task: goals, parameters, constraints and expectations. The text that follows gives a sense that these students have done this type of task before.
- Co-author Smithenry follows these same students into their physics class next year, where students from Gallagher-Bolos' class are mixed with those from another chemistry teacher who didn't take a similar teaching approach. And the difference in students is immediately obvious – comfort with leading class discussions and decision-making, comfort with asking themselves questions and collectively figuring out how to approach a science task, etc.

KCAS Connections

It is Complex!

Teresa Rogers
KDE Literacy Consultant

ELA

Former First Lady Laura Bush is quoted as saying, "Children and teachers need library resources – especially books – and the expertise of a librarian to succeed." This month, librarians from across the state met to deepen their understanding of how to support students and teachers in the quest for the perfect book.

In a workshop session entitled "Text Complexity," librarians examined the three-part model introduced in the Kentucky Core Academic Standards (KCAS), qualitative measures, quantitative measures, and reader and task considerations.

Standard 10 of the Kentucky Core Academic Anchor Standards for Reading states that students will read and comprehend complex literary and informational texts independently and proficiently. Appendix A defines text complexity as a three-part model that blends qualitative and quantitative measures with that of reader and task considerations. **Quantitative** dimensions of text complexity measure aspects such as word length, sentence length and text cohesion. These factors are typically measured by computer software such as Lexile levels. **Qualitative** dimensions of text complexity refer to those aspects of text that can be determined only by a human reader, such as levels of meaning and purpose, structure, and knowledge demands. The third dimension**, Reader and Task Considerations**, focuses on factors such as the reader's motivation, knowledge and experiences.

To choose a suitable text, it is critical to consider all three dimensions. Participants used a **Text Complexity Placemat**, Lexile level and excerpts from sample texts to determine an appropriate grade band. After understanding the process themselves, they discussed the need to share this information with community stakeholders and the best strategies to accomplish this task. More information and resources on this important topic can be found at:

Lexile
www.lexile.com

See COMPLEX *on Page 10*

Immersion Schools Teach Science and Math in Spanish

Jacque Van Houten
World Language and International Education Consultant

ARTS & HUMANITIES

For 22 years, Spanish has been the language of instruction for science and math at Maxwell Spanish Immersion Elementary School in Fayette County. At Bryan Station High School, students take Advanced Biology, Advanced Chemistry and Advanced Physics in Spanish. These schools are part of a growing trend across the country in language immersion education. For instance, California has 140 such programs, Utah has 98, North Carolina has 77, Texas has 53, Illinois has 35 and Oregon has 22 in Chinese, Spanish, French and Portuguese. Recent research by Thomas and Colliers (njrp.tamu.edu/2004/PDFs/Collier.pdf) shows dual-language immersion programs is the only program for English language learners to fully close the achievement gap.

Students in language immersion schools or strands within schools spend half of the day immersed in Spanish while learning math and science content. Instruction for language arts and social studies is provided in English during the other half of the day.

Immersion students can be expected to reach higher levels of second-language proficiency than students in other school-based language programs (Met, 1998), while more than three decades of studies consistently show that immersion students achieve as well as or better than non-immersion peers on standardized measures of verbal and mathematics skills administered in English (Cloud, Genesee, & Hamayan, 2000; Genesee, 1987).

Spanish immersion is available at Maxwell, Liberty and Northern elementaries, and Bryan Station Middle and High School (recognized in 2012 as Spanish Embassy School of the Year) in Fayette County and Hawthorn Elementary School in Jefferson County. The Kentucky Department of Education has a request for applications (RFA) posted at http://education.ky.gov/districts/business/pages/competitive%20grants%20from%20kde.aspx for grants to plan or implement new immersion programs.

Imitation is the Sincerest Form of Flattery

Nikkol Bauer
Chief Information Officer/District Technology Coordinator
Henry County school district

ENGINEERING IN SCIENCE

Mother Nature, as if she were a real person, would certainly be flattered by actions of biological engineers. While burs, shark skin or gecko toes do not have the capacity to care whether or not we humans mimic them, we do. Why? Biological structures and systems are so wonderfully efficient that someone observant enough recognizes the application in human endeavors.

The field of biomimetics or biomimicry, a specialized form of bioengineering, studies the structure and function of biological systems as models for the design and engineering of materials and machines. Some examples include:

- While picking the burdock burs out of his dog's fur, engineer George de Mestral noticed how the hooks on the burs clung rather well to fur. The result? After eight years of development, Velcro was born.

Photo Credit: postbear, License: Creative Commons

- Geckos, or more specifically the nanoscale split ends on the hairs on the toes of geckos, have recently inspired an entire field of research dedicated to synthetic gecko adhesion.
- The structure of shark skin, on a nanoscale, has led to synthetic surface treatments that prevent microbes from attaching. The applications of this anti-microbial technology appear in medical and computer industries, to name a few. In addition, the geometric arrangement of grooves on shark scales also make for a more hydrodynamic swimmer, a characteristic upon which automobile manufacturers and swimsuit companies have capitalized.

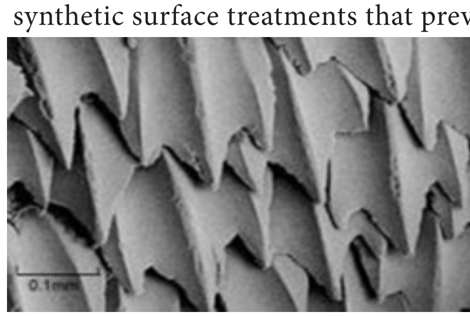


Photo Credit: AskNature, License: Public

For more information about biomimetics, including curriculum resources, visit the Biomimicry Institute, Biomimicry Education Network and AskNature.

Environmental Education: An Experiential Way to Teach and Learn LS1 Concepts

Elizabeth Schmitz
Executive Director
Kentucky Environmental Education Council

ELEMENTARY

Environmental education (EE) is all about using the environment to teach concepts that sometimes can seem abstract or irrelevant to students. Through environmental education, students engage in lessons in a hands-on, kinesthetic way. Even better, students can gain 21st-century skills like teamwork, communication and problem solving while learning scientific concepts. Here are a few ideas for teachers who are implementing the new science Kentucky Core Academic Standards (KCAS) in their classrooms and schools. Note that most of these suggested activities can be adjusted to better fit higher or lower grade levels.

Elementary School Teachers

Kindergarten: K-LS1-1 – "Use observations to describe patterns of what plants and animals (including humans) need to survive."

- Put two identical plants in the windowsill. Conduct an investigation to see how the amount of water affects plant growth.
- Take two identical plants and put one in a sunny place and one in a cabinet. Observe plant growth over two weeks.
- Look for places outside the school walls, such as in the school garden, where different insects live and what they eat.

First Grade: 4-LS1-1 – "Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs."

- Take pictures (nature walk, from home, etc.) that show plant/animals defense mechanisms.
- Look for holly bush leaves, thorns, stick tights, thistles, burdock seeds, turtle shells, porcupine, snails, squirrels, etc., and compare them to the fasteners on students' clothing
- Create a "gallery walk" of photographed items that foster discussion of how the structures promote survival.
- Go on observation walks to see how squirrels use their tails to stabilize themselves and wrap themselves up to keep warm. Compare this to how we wear coats to keep warm on winter. Observe how squirrels use their claws for climbing, stabilizing and gathering needs.
- Observe various mouth parts of animals/insects found in the schoolyard area. Encourage students to make a connection between the mouth structure and how the animal takes in its food.

First Grade: 4-LS1-2 – "Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive."

- Use live webcam websites to observe the behaviors of animals and their offspring. Try the Cornell Ornithological Society and the Kentucky Bluebird Association for resources.

Third Grade: 3-LS1-1 – "Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death."

- Collect a small monarch caterpillar and milkweed stalk with leaves. Provide a habitat in the classroom for students to observe the monarch's growth and development as it grows and goes through metamorphosis. Refresh milkweed as needed. After you release the adult monarch, students create a model depicting the life stages. Students create a model of another organism (other than human) and compare the stages.
- Fall and spring – tadpoles are abundant and are easily collected from pool covers and ponds. Set up a tank and have students observe and collect data using photographs and written descriptions as the tadpoles grow into froglets and then frogs. Return the frogs to a water environment and have students create a journal entry showing the stages they did not see – eggs and death.
- Observe a variety of seeds, such as lettuce and radishes. Plant them and observe their growth and development. Take weekly photographs and/or record weekly observations in a journal. After six weeks, compare the plants and students' journal entries.

Fourth Grade: 4-LS1-1 – "Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction" and 4-LS1-2 – "Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways."

- Observe organisms such as snails, earthworms, ants and other "bugs" living in the school garden. Record their structures and their activities. Have students learn more about them in field guides and other research materials.
- Have students observe plants you have pulled from the school garden. They should draw the plants, and measure, label and compare the structures of the plants. Students can then research how the functions of each structure contribute to the plant's survival. See Drawing on Nature, Animal Poetry, and Animal Charades in Project WILD.
- Conduct investigations of how an earthworm reacts to stimuli.

See www.bggreensource.org/pk-12/outdoor-classrooms/content-aligned-curriculum/ for complete lesson plans of the above activities.

From Molecules to Organisms: Structure and Function + Questioning + Patterns = Moving Toward Scientific Literacy

Tim Sears
Elementary Mathematics Consultant

K-12

My mother made me a scientist without ever intending to. Every other Jewish mother in Brooklyn would ask her child after school: So? Did you learn anything today? But not my mother. "Izzy," she would say, "did you ask a good question today?" That difference – asking good questions – made me become a scientist.

— Isidor Isaac Rabi (1898-1998), American Physicist, Nobel Laureate

Patterns exist everywhere. Noticing patterns is often a first step to organizing and asking scientific questions about why and how patterns occur.

One major use of pattern recognition is in classification, which depends of careful observation of similarities and differences. Objects can be classified into groups on the basis of similarities of visible or microscopic features or on the basis of similarities of function.

Clicking on http://visualizingmathematics.wikispaces.com/Math+and+Science will take you to a page where you will find activities and resources that provide examples for:

• NGSS Disciplinary Core Idea – LS1, **From Molecules to Organisms: Structure and Function**
• NGSS Science and Engineering Practice – **Asking Questions and Defining Problems**
• NGSS Cross Cutting Concept – **Patterns**

Science for All

How Do You Ask Questions?

Veronica Sullivan
Exceptional Children Consultant

DIVERSE LEARNERS

Without questions, there would be no answers. So why don't we teach students "how" to ask questions?

But we do, some would say. We model! I would like to go out on a limb and suggest to you that modeling may not be enough for some students to understand how to ask questions or answer them, for that matter. As a special education teacher, I realized this one day when I decided to ask a question that I thought was simple. However, it did not relate to the topic we were studying at that particular moment. I said to a small group, "What is your favorite food?" I was shocked at the delayed response. Once they realized what I was asking, they began to liven up. They sat up taller, their eyes brightened. I could see they were engaged. I then said, "Ask me a question, any question," assuming they would ask what my favorite food was. The table went silent. It was at that moment, I realized that all of my "modeling" of questions was not enough for my students.

Then what? I needed to teach my students how to ask questions. I knew I could increase engagement if I was asking a high-interest question. I couldn't spend too much time on personal experiences like favorites. I needed something interesting that was a little more educationally sound, so I used science. I started out with the traditional questions in an activity, but we didn't focus on answering the questions – we analyzed the questions, we learned to summarize the question, we did activities like sentence puzzles to add new and different ways to ask the same question. We looked at photos in the chapter and how the question related to the picture. Then it was time to leave the textbook and move them into asking their own questions.

Regardless of ability level, class size or grade level, asking critical questions is a fundamental skill in education. All students can learn to form their own questions, and teaching this skill can be part of everyday practice. One method for teaching this skill is the Question Formulation Technique (QFT). The six steps in this technique are designed to allow student ownership of learning. They are:

Step 1: Teacher designs a question focus – Must be a prompt, like a visual, or a statement to attract student attention. (Not a teacher question)

Step 2: Students produce questions – Students follow set rules and produce questions without input from the teacher.

See QUESTIONS *on Page 10*

A Nova Episode

Kathy Anderson
Division of Learning Services

DIVERSE LEARNERS

Students who demonstrate understanding can:

1-LS1-1, "Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.*[Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.]"

Use the KET program *Nova* episode *Making Stuff Wilder* to introduce how humans design solutions to problems by identifying how plants and animal use their body parts and internal makeup to help them survive, grow and meet their needs. View the episode at www.pbs.org/wgbh/nova/tech/making-more-stuff.html#making-stuff-wilder.

Students will use the "creative problem-solving process" to identify a real-world problem (hopefully a problem that has not been resolved) or a different answer to a problem that may already have a solution. The solution to the problem will include a plant or animal characteristic/s to help them solve the problem.

Resource: *Creative Problem Solving: A Teacher's Guide to Effectively using CPS in Any Classroom* by Joel E. McIntosh and April W. Meacham. This short-but-informational book offers a rationale for teaching creative thinking and creative problem solving. Divergent and convergent (critical) thinking strategies also are included. Next, the book focuses on the six steps in this type of problem-solving process. Elementary and secondary problem-solving ideas are provided.

The six steps in the creative problem-solving process are:

1. Mess-Finding: During mess-fining, students identify a general topic ("mess") on which to apply the rest of the process.
2. Data-Finding: During data-finding, students take an inventory of what they know, need to know or would like to know about the selected mess.
3. Problem-Finding: During problem-finding, students identify a single statement of a problem associated with the mess.
4. Idea-Finding: During solution-finding, students identify a set of criteria to evaluate their solutions and identify the many possible ways they might address their identified problems.
5. Solution-Finding: During solution-finding, students identify a set of criteria to evaluate their solutions and identify a single solution for their chose problem.
6. Acceptance-Finding: During acceptance-finding, students generate a plan of action designed to implement their solution.

Other Connections

Update on Kentucky STEMx Network – Performance Guide Development

Mindy Curless
KDE STEM Consultant

Development of the Kentucky STEMx Network continues, with the intent of organizing science, technology, engineering and mathematics (STEM) stakeholders to help Kentucky students become college- and career-ready. The Kentucky STEMx Network, facilitated through the University of Kentucky's P20 Innovation Lab, is part of a national STEMx network organized by Battelle Ed.

Kentucky STEMx has three strategic objectives:

Establish an adaptable communication and coordination infrastructure for Kentucky STEM education.

Describe and disseminate the characteristics of highly effective STEM initiatives.

Maintain continuous growth and development of STEM P20 formal and informal educators in Kentucky.

The Kentucky STEMx Performance Guide will be a major tool for the second objective, "Describe and disseminate the characteristics of highly effective STEM initiatives." This tool is intended to help all STEM stakeholders effectively improve in their role for Kentucky STEM students. The guide will look at STEM education through the lenses of teaching, learning, leading, evaluating, budgeting and sustaining. Although the performance guide is only partially complete and in DRAFT form, a page from the guide is included to elicit feedback from teachers as development continues. This provided document is the draft of the "teaching" lens. Please share any feedback about this tool with melinda.curless@education.ky.gov. Your input is greatly appreciated.

See STEMx on Page 10

There is Power in Teamwork

Christine Duke
KDE Elementary Science Consultant

INFORMAL SCIENCE EDUCATION

As we continue to roll out the Next-Generation Science Standards (NGSS) across Kentucky, teachers should recognize the connection between formal and informal science education as an important relationship that can foster collaboration and lead to outcomes that increase student learning of the world around them.

Education Week (2011) published a special report, *Science Learning: Outside the Classroom* (www.edweek.org/go/ScienceReport), suggesting that an informal science movement was building momentum in the U.S. This report recognized various venues, such as exploration, competitions, gaming and simulations, and discovery play, in which informal science education (ISE) can enhance formal science education. These science learning opportunities, as well as numerous others, frequently occur outside of the classroom. Greater effort to collaborate and connect with informal education providers at the time of the NGSS rollout in Kentucky can only enhance our efforts to move students toward being scientifically literate individuals.

Numerous informal education opportunities across Kentucky support students and teachers in science and STEM education, such as:

- museums and historical centers
- public libraries
- zoos
- parks
- industry
- after-school and summer clubs/programs
- the media

By encouraging students, their families and all educators to participate in informal science learning opportunities, you will be helping to move the NGSS forward in Kentucky.

Much content knowledge and foundational understanding can be developed through engagement in science opportunities that are meaningful outside of the classroom.

Does your district have a list of available informal education resources for your specific area? If not, start compiling this information and share it with others.

There is power in team work. Now **is** the time to link students, parents and educators with informal education opportunities in Kentucky.

Using CIITS to Support Science

Joe McCowan
KDE Consultant

Are you aware of the wealth of science resources in CIITS? Overall CIITS usage is really starting to heat up, with recent stats showing more than 1 million educator logins last month and 55,000 student logins in one week. As a result, many educators are using CIITS to search for standards-based resources to align instructional planning and deliver content to students in science.

Science is supported in CIITS, and you can find instructional resources in a variety of places. You can find science instructional resources in the Classrooms module, and you can continue to create, align and share materials on your own by using the tools available in CIITS. Along with resources loaded in CIITS from KET Encyclomedia/Discovery Education, SAS Curriculum Pathways, ACT, Thinkfinity and the School Improvement Network, you also can access related resources through the Web links posted on the CIITS homepage. You can use CIITS to search resources aligned to the standards you are looking for to help make critical connections to the topic of the month, Life Science. Also, don't forget that we are loading the new science standards in CIITS, and we will continue to align additional instructional resources with these new standards as usual.

We hope you are finding what you need in CIITS and the instructional resources are proving to be quality materials to support highly effective teaching and learning. The upper left-hand corner of the CIITS homepage now contains a suggestion box to provide feedback or suggestions. Please continue to pass along new ideas that might help us improve the CIITS experience and strengthen the science content area.

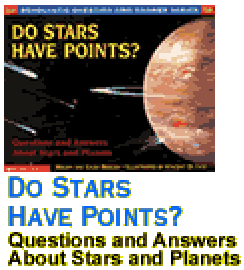
Resources from Invitational Research Symposium on Science Assessment

The K-12 Center at ETS recently collaborated with a dozen other organizations and held the Invitational Research Symposium on Science Assessment, which brought together many of the individuals at the forefront of K-12 science education and assessment. The purpose of the symposium was to discuss how the latest advances in measurement, cognitive science and technologies could support the development of next-generation science assessments — formative, benchmark and summative — to measure the very complex competencies called for in the NGSS.

To find out more, please visit the website at www.k12center.org/events/research_meetings/science_assessment.html.

Using Books as Models for Developing Inquiry

Kathy Mansfield
KDE Library Media/Textbooks Consultant



Elementary Book Series: **Scholastic's "Questions and Answers"**

Sample titles:
Did Dinosaurs Live in Your Backyard?
Why Don't Haircuts Hurt?
Do Stars Have Points?
Do Whales Have Belly Buttons?
How Do Flies Walk Upside Down?
Can it Rain Cats and Dogs?

Children are naturally inquisitive, particularly about the world they observe around them. The books in Scholastic's "Questions and Answers" series are great resources to encourage students to seek answers to their questions about what they see and hear. Teachers and librarians can share several of the books in the series with students to demonstrate the format and the types of questions asked.

For example, most questions and their answers are concise and take up a small portion of a page. Illustrations help to explain or demonstrate the answers. Small groups of students can choose topics and create questions about those topics similar to the format of the books in the series. The classroom teacher and school librarian can work together to assist students in finding the answers they seek using various print and digital resources or through observations and experiments. Culminating projects might include an illustrated book similar to those in the series, a slide show with each slide representing a question and answer, a mock "talk show" or "quiz show," or any number of creative ways to share the results of the inquiry activity.

Professional Learning

Outstanding Formative Assessment – a close focus one-day workshop

Presented by author and assessment expert Shirley Clarke, University of London
March 11, 2014

This training will introduce new examples of the elements of formative assessment (learning culture, planning, learning objectives, success criteria, talk and questioning, and feedback). Learn practical strategies for incorporating the elements of formative assessment in the classroom, using clips of Seamus Gibbons, an exceptional inner London teacher, to illustrate what the strategies look like in practice. The training will also highlight successful staff development strategies.
$125

Complete details at www.rsvpbook.com/formassessoneday.

Professional Developers Institute

Using Elementary and Middle School Mathematics: Teaching Developmentally PD Edition

Presented by co-author Jennifer Bay-Williams
March 6-7, 2014

Learn how to use the book Using Elementary and Middle School Mathematics — Professional Development Edition directly from one of the authors. Bay-Williams will focus on specific aspects of the book that connect to the Common Core State Standards Content and Mathematical Practices, engage you in professional development activities that are in the book and consider ways the book can help in your work with teachers, principals, parents and students.
$300 includes purchase of book, or $175 if you already have a copy

Complete details at www.rsvpbook.com/pdinstitute.

Save the Date!

Fourth Annual Meeting the Challenge Conference

July 22-24, 2014

More information coming soon!

Resources

Please take a minute to check out these resources. The following overview information comes directly from the sites. You will find a wealth of resources as you explore these science sites.

Need Science, but Not Too Much?

Check out *Scientific American*'s 60-second science podcast series. These short audio clips present interesting and engaging material in an easily digestible way. Recent topics include whale ear wax, robots and body language, and ways to determine whether a canvas painting is safe for travel.
www.scientificamerican.com/podcast/podcasts.cfm?type=60-second-science

Science Sites of the Week

Would you like to receive a weekly e-mail featuring reviews of some of the best sites in earth science, environmental science and geography? Contact Mark Francek (mark.francek@cmich.edu) to be added to the "Earth Science Site of the Week" listserv. You also can use the resource page found at http://webs.cmich.edu/resgi/. Both are very useful resource pages.

Science News for Students

Science News for Students (SNS) is an award-winning free online publication dedicated to students, parents and teachers that connects the latest in scientific research to in- and out-of-classroom learning.

SNS launched in 2003 as *Science News for Kids* by the Society for Science and the Public (SSP) as a youth edition and companion to *Science News* magazine, with content tailored to be accessible and interesting to student scientists and serves as the flagship publication of the Student Science section of SSP's website.

SNS offers timely, interesting news stories and features, accompanied by suggestions for hands-on activities, books, articles and Web resources.

It attracts nearly 4 million visitors annually and is available for free due to the support of organizations and individual donors.
www.societyforscience.org/science-news-students
www.societyforscience.org/newsletters

Professional Learning Opportunities

ITEEA Orlando
March 27-29, 2014

ITEEA's 76th ANNUAL CONFERENCE

Registration and housing are open. Technology and engineering teachers bring STEM to life in their classrooms every day. The Teaching Technology and Engineering 2014 Showcase in Orlando is the place to share technological and engineering literacy core connections.
www.iteea.org/Conference/TeachTechShowcase2014.pdf

STEMx

Continued from Page 6

TEACHING	Introductory	Partial Immersion	Full Immersion
Interdisciplinary	An educator plans, facilitates, and implements multi-disciplinary learning experiences that integrate two or more STEM disciplines in or outside schools.	Two or more educators collaborate to facilitate and implement interdisciplinary critical thinking/problem solving experiences that integrate two or more STEM disciplines in authentic contexts for SOME students.	Educator curricular teams facilitate, and implement interdisciplinary or trans-disciplinary STEM critical thinking/problem solving experiences at least one time each year with ALL students. These educator teams implement authentic curriculum integrating two or more STEM disciplines.
P20 Align	Informal community of instructors (minimum of two) implements STEM experiences that manifest KCAS with reflection on content learning progressions.	Vertically aligned professional learning communities in which instructors provide STEM experiences that manifest KCAS standards and reflect on content learning progressions.	Vertically aligned professional learning communities in which instructors across the school provide intential STEM experiences that span the grade levels, and robustly aligned with KCAS standards.
Rigor	The instructor(s) evaluate the STEM experience(s) in the context of the 5 dimensions of RIGOR and modify the experience to highlight at least one dimension of rigor.	All STEM experiences are designed or modified to ensure that 2 or more components of rigor are met through the experience, and students are explicitly taught the elements of rigor.	All STEM experiences are designed or modified to ensure that all components of rigor are met through the experience, and students are explicitly taught the elements of rigor.
Critical Thinking/PS	Instruction focuses on students developing problem/question, plausible plans, and constructing answers and solutions from data. Educator supports student analysis of clarity, accuracy of questions and relevance of data.	Instruction focuses on students developing questions, plausible plan, and formulation of answers/conclusions/ solutions. Educators support students to focus on clarity, accuracy, and relevance of questions, data, and solutions, and consider alternative solutions.	Educator immerses students in critical thinking strategies as students particpate in authentic problem solving experienes. Critical thinking instruction focuses on evaluting questions, evidence and conclusions for clarity, accuracy, and relevance, and problem solving for depth, breadth, and significance of evidence and solution. Educator also guides students in evaluatoin of bias, and adherence to alternative viewpoints and solutions.
Community Connections	The instructor(s) make a meaningful connection to the community (local or global), through business/industry, or post-secondary education, though the STEM experience.	The instructors make meaningful connections to the community (local or global), through business/industry, or post-secondary education, though multiple STEM experiences.	The instructors make meaningful connections to the community (local or global), through business/industry, or post-secondary education, through all STEM experiences.
Career Awareness	The instructor(s) make a meaningful connection in content classrooms to the career education experiences provided to some students.	The instructors make meaningful connections in content classrooms to the career education experiences, including student lead sharing of connections.	The instructors make meaningful connections in content classrooms to the career education experiences, including student lead sharing of connections, perhaps pressenting in teams to highlight commonalities and differences in the experiences.

QUESTIONS

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The teacher instructs the students on the difference between open-ended and closed questions. They analyze and categorize their own questions.

Step 4: Students prioritize questions – The teacher will set the criteria, such as asking the students to pick three questions they want to answer about the topic.

Step 5: Students and teacher decide on next step – Students share their priority questions and the group decides what to do next, such as which question they will answer.

Step 6: Students reflect on what they learned – Teacher reviews the steps so the students realize what they have accomplished.

You can read about QFT in the book *Make Just One Change: Teach Students to Ask Their Own Questions* by Rothstein and Santana (2011). There also are articles and links that provide an overview of the step-by-step procedures for using QFT, along with teacher reflections and examples of how they used QFT with their students. For more information on QFT, please see the following resources:

http://hepg.org/hel/article/507
http://rightquestion.org/blog/student-engagement-special-education-classroom/
http://rightquestion.org/make-just-one-change/
http://media.rightquestion.org/resources/Overview-of-the-Question-Formulation-Technique.pdf
http://www.pkwy.k12.mo.us/inside/curriculum/CA/secondary/file/Question%20Formulation%20Technique.pdf

LIVING ORGANISMS

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shows a teacher working with her students to develop their own experiments to explain the carbon cycle in regard to photosynthesis. This video show how the students work toward understanding the effects of photosynthesis, the energy movement within the ecosystem and how changes to the living organisms affect the overall environment.

COMPLEX

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http://education.ky.gov/curriculum/docs/pages/kentucky-core-academic-standards---new.aspx

Text Complexity Resources

http://education.ky.gov/curriculum/lit/Pages/Text-Complexity-Resources.aspx

VICTIM

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their questions need a little direction toward the topic we want them to think about. Also, we will certainly need to help them classify their questions by those that can be investigated.

Here is a scenario from a 1st-grade classroom as part of a unit addressing 1-PS4-3, "Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light." The students listen to a story, *Bear Shadow* by Frank Asch. They get a chance to play experience with their shadows outside. Back inside, the teacher shows them some materials (wax paper, clear plastic, tin foil, etc.) and asks them which will make shadows. The students classify the materials and keep a log using a T-chart. Next, students explore shadows and light at various stations around the room. These are described below. Before they get started, they are reminded to keep track of what they find out and what they wonder about in a science journal. They may use pictures, words or both to keep track of their thinking.

Stations:

- Light box – students place various objects on a light box and observe what happens.
- Overhead projector – students place various objects on or in front of the projector and observe what happens.
- Flashlights and materials students use materials similar to those classified with the group to see how they interact with light from the flashlights.
- Measuring shadows – students place a flashlight at premarked locations and use linking cubes to measure the shadow cast by a golf tee.
- Where does the light come from? – students predict where the light must be located to make various shadows shown on a worksheet. Then they test their predictions with models.
- Colored shadows – students explore making shadows with colored light.
- Books about light and shadows.

After time exploring the stations, the teacher gathers students and brings them back to the original question, "Which materials make shadows?" She guides them as they discuss and develop a rule for making shadows. Then she shows them a new material and asks them to apply their rule to determine if it will make a shadow or not. She allows them to argue this point, always insisting that they use evidence from their explorations.

Later, the teacher asks students to talk about other things they noticed as they were exploring how light acts with different materials and objects. She has them think of other ways they might sort the materials (e.g., things light goes through and things it doesn't). She then asks students to use their notebooks to talk about other questions that came up as they were exploring light. She lists these and the class talks about which they could explore further and find answers to using the materials they have. They also talk about what they might do to find the answers to some of the other questions. Students then choose a question they can investigate with materials they have and talk to partners about how they will try to find the answer. They must write their question in their science journal and keep track of what they do and what they find out. Their findings are the subject of the next class meeting, and they know they will be expected to use information from their journals as evidence.

While this scenario is based on a performance expectation that does not include the practice of asking questions and defining problem students will need to have a question they are trying to answer to plan and carry out an investigation.

The teacher models this at first by asking which materials will cast a shadow. After that, students determine their own questions. Helping them to decide which can be investigated is the teacher's next step. One could argue that the first part of the scenario was enough to meet the performance expectation: with support from the teacher, students planned and carried out an investigation about how light interacts with materials (makes shadows or doesn't.) While this would indeed be easier and take less time, it also would limit students' understanding of various other ways light interacts with materials and their opportunities for developing investigations about questions that interest them and for investigating a science question in a scientific manner. It would take the opportunity for students to perform the science practices and, therefore, the intent of the NGSS out of the activity.

Collaboration and Connections:

The *Science Connections* newsletter offers a forum for science professionals across Kentucky to collaborate and share classroom experiences. Please share with colleagues across the state the instructional strategies, resources and lessons that you have learned. Your entries should relate to one or all of the topics for the next month as noted below.

Coming up:	Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
January	Developing and Using Models	ESS1: Earth's Place in the Universe	Cause and Effect
February	Planning and Carrying Out Investigations	PS1: Matter and Its Interactions	Scale, Proportion and Quantity

E-mail your contributions to christine.duke@education.ky.gov.
All submissions are needed by the 20th of the month.